

ON THE TREATMENT OF FLAT-FOOT.¹

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THERE seems to be a difference of opinion in the profession concerning the prognosis in a case of confirmed flat-foot. Some surgeons, assuming that a perfect functional result is beyond the limits of treatment, are satisfied if they succeed in relieving the most distressing symptoms. Others write confidently of a "radical cure."

It is doubtless due to the frequent occurrence and crippling effects of flat-foot, and unfortunately to the present unsuccessful management of many a case, that we still possess such a multitude of therapeutic measures. In my endeavor to point out some of the indications and limitations of certain more or less familiar procedures, I am guided chiefly by personal observation of the work of others. Inasmuch as my experience in the strictly operative treatment of this affection is meager, perhaps I shall be considered as not giving due credit to the knife.

Although it is quite foreign to my purpose to deal with the pathology of this interesting condition, I desire to emphasize *three* features that seem of special importance in a rational consideration of treatment. First, that we have at the medio-tarsal joint a simple partial dislocation, and not a unique condition occurring nowhere else. We find the anterior surfaces of the os-calcis and astragalus displaced downward and inward; the astragalus to a greater degree owing to a tilting of these two bones from the abnormal direction of the transmitted weight. The posterior surface of the scaphoid and the cuboid are likewise displaced downward and inward. The ligaments are stretched, especially

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important being the strong inferior calcaneo scaphoid, the chief support of the anterior end of the astragalus. In fact, in an extreme case it is the anterior surface of the astragalus which is partly concerned in forming the prominence on the inner side of the foot. Clinically, also the similarity to a dislocation is seen in the two classes of cases. In the paralytic or non-spastic cases a manual adduction and internal rotation of the fore-foot causes the deformity to disappear, and the same result occurs in the stiff flat-foot when a like position is obtained by a forcible reduction under an anæsthetic. Second, That we have a throwing outward or valgus of the fore-foot. Draw a line from a point which bisects the foot laterally at the medio-tarsal joint, backward to a point bisecting the heel. Also one forward from the same point to the middle toe. In the normal foot these two are one and the same straight line. In well-marked flat-foot the anterior line is deflected from twenty to forty degrees. *Why* this occurs is easily apparent. When the curve along the inner border is broken and approaches nearer a straight line any two constant points on this line become a greater distance apart; but as the outer border of the foot is practically without a curve, this lengthening on the outer side does not occur. Thus is the base of the fore-foot on the inner side forced forward and the valgus results. This deformity must be recognized as clearly as is the breaking down of the arch, for unless the valgus is corrected, we have provided no support within the foot itself, for the anterior end of the arch. Third, That some flat feet are rigid and others are not. This rigidity may be overlooked when slight, unless the movements of the foot are compared with those of a normal one. This rigidity in early cases is due to spasm, for it disappears on rest, later it results partly from spasm and partly from inflammatory adhesions between the tendinous structures, and in old cases to changes in the bony surfaces. The amount of stiffness is an indication of the severity of pain. Its relation to the application of mechanical supports will be mentioned later.

Methods of treatment easily group themselves in three classes, according to the mechanical principle involved. First, those that strengthen the arch by means directed to its bony framework; second, those that transmit the weight of the body through the outer border of the foot and thus relieve the arch;

third, those that support the arch directly by pressure. In the first class we have Ogston's operations and its modifications. A bony ankylosis is obtained in part of the medio-tarsal joint by a resection of the adjacent surfaces of astragalus and scaphoid and their fixation in a correct position, according to Ogston, by ivory pegs. Surgically this is not difficult, nor is it a dangerous operation with asepsis. It is applicable only to severe cases. It requires, according to its originator and others, a three months' rest in bed, else there is no practical assurance against a relapse.

Dr. Ogston reported cases where the pain was not relieved. One case where the ivory pegs were extruded, and several where the deformity recurred after several months with increasing pain. Yet, on the whole, patients were relieved by the operation. I recall but one case that I have been able to follow completely, but I fear it is a somewhat typical one. The operation was easily accomplished and there were no wound complications. When a second plaster splint was applied after two weeks the wound was healed and the position excellent. After the regulation time the patient began to walk, but with some pain. When seen about a month after discharge from hospital the deformity had recurred completely and the pain was severe. In a second case I saw a relapse several months after an Ogston's operation. Several well-known surgeons tell me that even their best cases have never been *quite* satisfactory. Whether this experience is universal or not I do not know. Although widely published in the *Lancet* in 1884, it does not seem to have gained an equally wide popularity.

I would call attention to the evident fact, that a three months' rest in bed even without operation would be expected to improve a flat-foot case, when the etiological factor is so often overwork, or rather overstanding, in an ill-developed youth.

Hare's operation would exclude the pegs and mortise the bones by an irregular section. This must shorten the foot, but removes the possibility of necrosis.

Kelly recently proposed to remove a wedge from the scaphoid and cuneiform bones. The idea seems illogical and inconsistent with the pathology. I do not know that it has been done.

Golding Bird's old procedure of excising the astragalus need only be mentioned.

In these and similar procedures the highest attainable result is a stiff and painless foot; yet in practice this is often not the only exception to a radical cure.

According to the second mechanical principle mentioned, Mr. Thomas, of Liverpool, in 1886, published the following method: To raise the inner side of the sole of the shoe sufficiently to throw the weight on the outer side of the foot.

The arch is thus relieved and the pressure is transmitted through the cuboid instead of through the scaphoid.

A few details are important. The building up of the sole must extend from the extreme posterior limit of the heel to the ball of the great toe, and not beyond, so as to permit the toes to rest firmly on the ground. The height of the added sole should be one-third to one-half an inch on the inner side, sloping gradually to the outer. The shoe must fit snugly or else the foot will slide inside and not be twisted or "rolled over." Many cases at the Ruptured and Crippled Hospital are treated in this way and our general impressions concerning its sphere of usefulness are confirmed by a detailed report published in 1890 by Dr. Townsend giving the results in twenty-five cases that could be well followed.

We have here an excellent therapeutic measure applicable even to the poor who must, if possible, continue at work. It is simple and cheap but it has its limitations. If we roughly divide the cases into three classes according to the severity, in the milder cases we expect a most satisfactory result. These are those where there is a slight sinking of the arch, where pain is present only after standing, and the chief complaint is that the foot is easily fatigued. There is very little stiffness in these feet and twisting is not painful. The improvement begins within a few days, after a short time there are no symptoms and after a few months the patient can return to his ordinary shoes with no further trouble. Inasmuch as these mild cases if neglected become crippling, I should like to emphasize the success of this simple measure. In the moderately severe cases also much can be accomplished by Thomas' method. Cases of several months duration with severe pain, well marked deformity and stiffness

can be treated in this way if the patient is taught to manipulate his foot every night. He should with his hands rotate the fore-foot inwardly and adduct it, and while holding it thus should flex and extend it, all the while forcibly twisting the foot in exactly the opposite directions to that taken naturally by the deformity. A few minutes thus spent brings such marked improvement that the patient continues it daily without urging. After wearing the shoe a year or so the patient will consider himself cured and discard it. However, the surgeon will recognize that the deformity in part remains, and after a time there may be a return of pain that will admonish the patient to wear his Thomas shoe for a longer period. In the very severe cases, however, those spoken of by some authors as acute or inflammatory flat-foot, where the valgus is pronounced, the spasm continuous, and the pain severe, this method has proven entirely inadequate and cannot be recommended.

A second method founded on this same mechanical principle is the supra malleolar osteotomy of Trendelenburg, introduced here by Dr. Willy Meyer of New York, who reported two cases in 1890.

Reasoning from its successful employment in correcting the "traumatic flat-foot," so called, following a badly reduced Pott's fracture, he was led to employ it in the idiopathic cases.

A simple bow-leg is produced by a cuneiform osteotomy of the tibia about two inches above the ankle joint. Impressions of the foot taken after the operation show that the weight is transmitted entirely through the outer border and the arch has no contact with the ground.

Indirectly both this and Mr. Thomas' method correct the eversion of the fore-foot by the counter pressure of the transmitted weight along the outer border and thus crowd back the anterior end of the arch. The three patients that I have seen were all greatly benefited by the operation, but said they felt unsteady in walking. However, that might disappear in time. Theoretically it would seem that unsteadiness would inevitably follow if the angle in the tibia is so acute that the patient walks entirely on the outer border, while if less acute, so that part of the weight is still transmitted through the arch, a further breaking might result, yet it seems as if this operation offers much encouragement for severe cases.

The third mechanical principle, viz., support of the arch by pressure is applied in so many ways that we mention but few. The elliptical steel spring, known often as Tiemann's, and the stiff steel supports made according to the shape of a normal foot are all useful if applied in selected cases. The point is this: When there is no spasm, that is in cases where the foot is not stiff and returns easily to a correct position by pressure, they are all satisfactory. But many of us have occasionally been disappointed in having a patient complain bitterly of the pain caused by these irons or pads and refuse to wear them. But this occurs only in feet more or less stiff.

However, by a proper preparatory treatment these supports can be made applicable to any case. Some years ago Mr. Willett, in the eighteenth volume of the St. Bartholomew Hospital Reports, advised for these stiff feet a complete breaking up of all these adhesions and a reduction of the deformity under an anæsthetic. I do not think that this procedure as a preliminary step to the application of a mechanical support has been sufficiently dwelt upon. If it is possible to reduce this partial dislocation and then retain it by an efficient support, where is the field for an Ogston's operation? Personally I have yet to see this manual reposition fail when intelligently, persistently and forcibly attempted.

Certain details are important if it is to be successfully done. The anæsthetic must be pushed to the full surgical degree.

While the heel is firmly held an attempt is made to move the medio-tarsal joint in its full physiological limits, the fore-foot is flexed and extended, adducted, abducted and rotated with firm pressure in each direction, oft repeated. The adhesions are heard to snap and the range of motion increases. The foot must then be retained in a well padded but tightly fitting plaster splint in a strongly adducted and internally rotated position—in fact, in a position exactly opposite that formerly assumed by the flat-foot. This over-correction can scarcely be made too forcibly. The pain following is not severe and seldom lasts more than a day or so. The plaster should be left on a week and when removed the foot will be found in a fully corrected position but stiff. Any well-fitting brace can now be applied and a system of massage and manipulation inaugurated. The purpose is to re-

gain free and painless motion in all directions and the normal functional elasticity. I quote from Dr. Royal Whitman, of New York, who has given these cases a great deal of attention: "The foot is first immersed for ten minutes in hot water, afterwards vigorously massaged, especially about the dorsum and is then slowly forced into a position of adduction. * * * This inward twisting is at first resisted by a mixed voluntary and involuntary muscular spasm which gradually gives way under steady pressure. When the limit of adduction has been reached the foot is firmly held until all pain has subsided, when the patient is instructed to make voluntary movements of flexion and extension. The foot is then released and twenty minutes of voluntary exercises follow and at intervals during the day the patient by active muscular efforts and passive motion constantly works to one end, namely to regain the lost power of adduction while once daily the twisting is performed by the surgeon."

During the ten days more or less, while this active massage is being performed, the patient is allowed to walk a little, wearing whatever support has been selected. The most satisfactory in practice and the most scientific in theory of any support with which I am acquainted is the brace advocated by Dr. Whitman.

In each case it is made on an iron mould with the cast of the foot in the corrected position as a model. This cast is taken a few days after the twisting, by removing the plaster splint for the purpose. Another plaster splint is usually applied until the brace is ready. This steel brace extends from just behind the ball of the great toe to a point in front of the inner tuberosity of the os calcis, thus the foot rests on its normal supports, the inner flange reaches to a point in front of and a little below the internal malleolus, while the small outer one fits in behind the base of the fifth metatarsal. The weight on the outer border forces the inner part of the brace snugly up against the weak arch. The time required from the date of the anæsthesia until a patient can walk about with some comfort on these well-fitting supports is about three weeks. In a foot without stiffness of course they can be applied without the preliminary twisting and massage.

These braces should be worn some six or more months depending on the severity of the cases, during which time the patient should himself continue the twisting and massage.

They can then gradually be laid aside. The ultimate result is a flexible foot in a correct position without pain and can justly be considered a radical cure. Although the proper application of this brace requires some skill in the use of plaster of Paris and a wise attention to the details of massage, the results warrant its use in an important case.

Let me emphasize the wisdom of forcibly twisting under an anæsthetic, and of the subsequent massage for any case of flat-foot with stiffness, no matter what mechanical appliance is chosen. Lack of time forbids my mentioning other appliances acting according to the same mechanical principle. In conclusion let me urge the importance of an early recognition of this trouble. In any case of pain in the feet and ankles not easily explained, a careful examination should be made, bearing in mind the insidious commencement of flat-foot. Too often the early cases are given a prescription for rheumatism and assured that the pain will wear itself out.